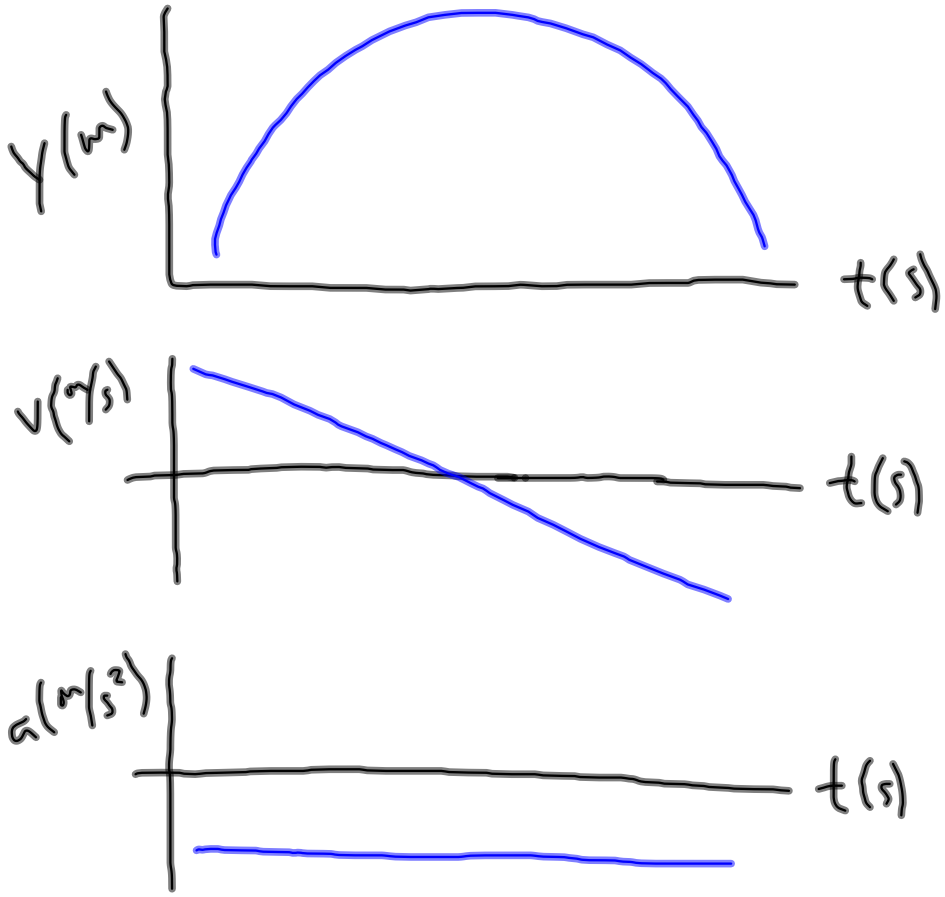
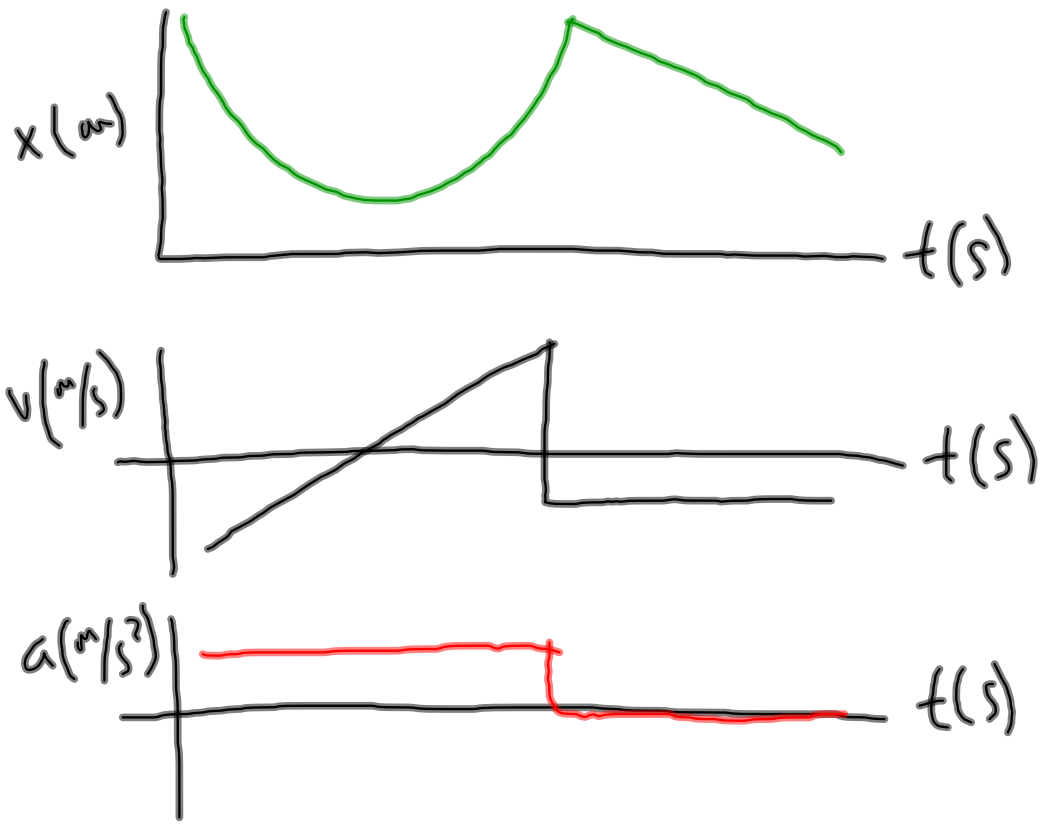
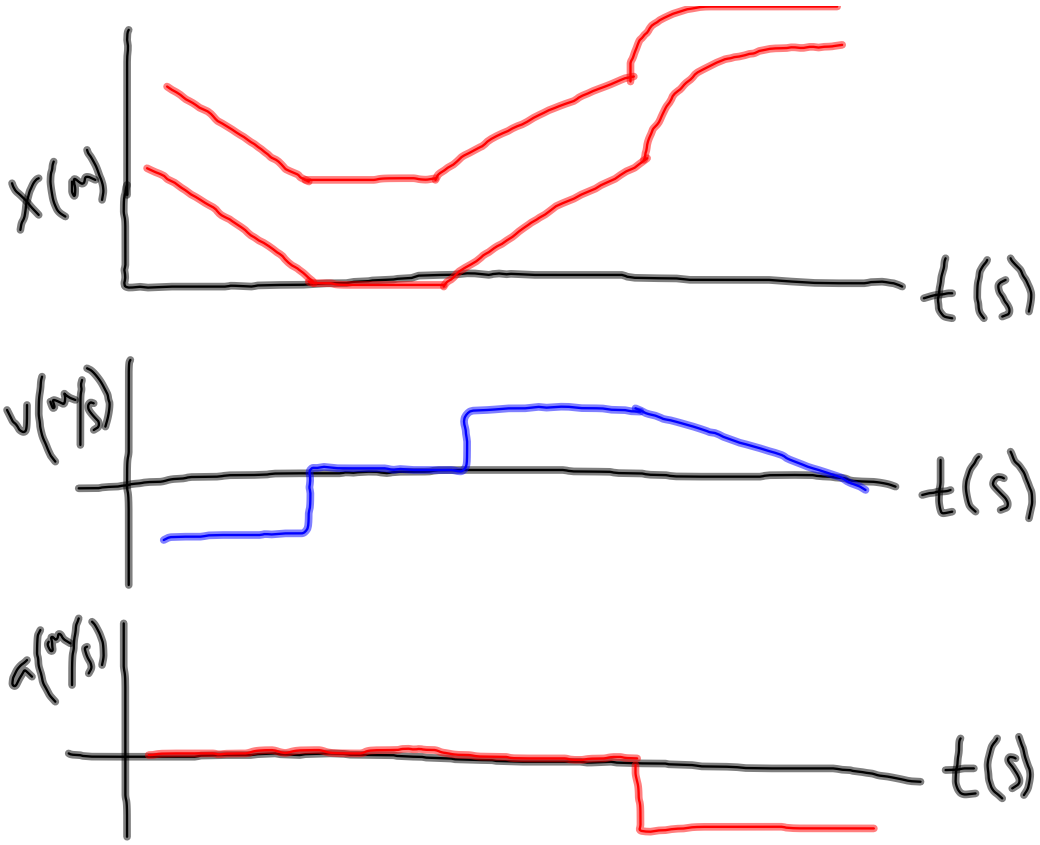
A coin is tossed vertically upward.
- What happens to its velocity while it is in the air? Draw a position v. time graph and velocity v. time graph to verify.
- Does its acceleration increase, decrease, or remain constant while it is in the air?



Initial Shape (d/t or v/t)	Mapping Shape (v/t or a/t)
Curve (⌒)	Line with slope (/)
Line with slope (/)	Horizontal line not on axis (—)
Horizontal line (–)	Horizontal line on time axis (—)

Initial Shape (v/t or a/t)	Mapping Shape (d/t or v/t)
Line with slope (/)	Curve (⌒)
Horizontal line not on axis (—)	Line with slope (/)
Horizontal line on time axis (—)	Horizontal line not on time axis (–)


x (m)
t (s)
v (m/s)
t (s)
a (m/s²)
t (s)

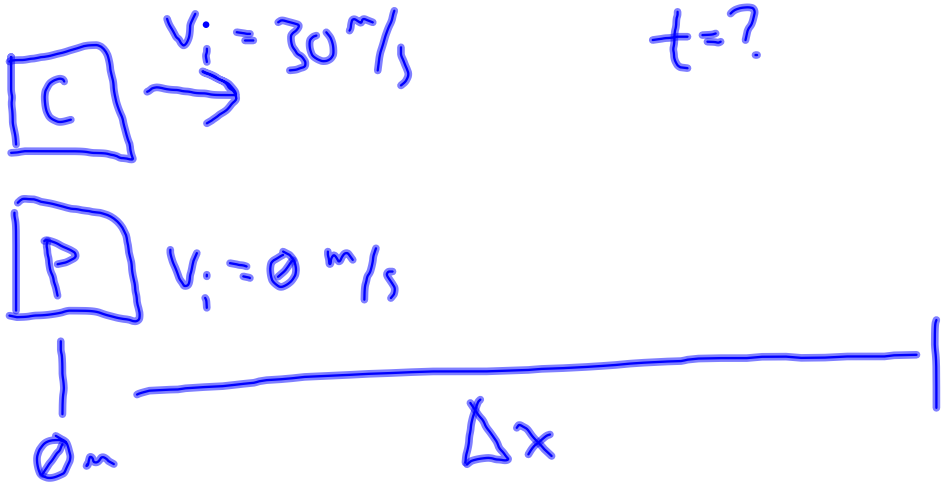

x(m)
t(s)
v(m/s)
t(s)
a(m/s)
t(s)

One-Dimensional Motion:

- Free-fall:
  - $a = a_g = 9.8\ m/s^2$ (down)
  - ignore air resistance
- State our directions
- Choose (wisely) where you place your zero point
- Free-fall in y-direction
- Kinematics Equations:
  - $\Delta x = v_i t + \frac{1}{2} a t^2$
  - $v_f^2 = v_i^2 + 2a\Delta x$
  - $v_f = v_i + at$
-

Variable	Units
v_i	m/s
a	m/s^2
v_f	m/s
t	s
Δy or Δx	m

A speeder passes a parked police car at 30.0 m/s. The police car starts from rest with a uniform acceleration of 2.44 m/s/s.
a) How much time passes before the speeder is overtaken by the police car?
b) How far does the speeder get before being overtaken by the police car?



$$\Delta x_c = v_{ic}t + \cancel{\tfrac{1}{2}at^2}^{0} \qquad \Delta x_p = \cancel{v_{ip}t}^{0} + \tfrac{1}{2}a_p t^2$$

$$\Delta x_c = \Delta x_p$$

$$v_{ic}t = \tfrac{1}{2}a_p t^2$$

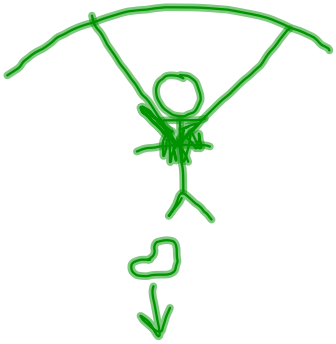
$$t = \frac{2v_{ic}}{a_p} = 24.6\ s$$

b) $$\Delta x_c = v_i t + \cancel{\tfrac{1}{2}at^2}^{0}$$

$$= (30\ m/s)(24.6\ s)$$

$$= 738\ m$$

A parachutist descending at a speed of 10.0 m/s loses a shoe at an altitude of 50.0 m
a) When does the shoe reach the ground?
b) What is the velocity of the shoe just before it hits the ground?



0 m

b) $V_i = -10\ m/s$

$a_g = -9.8\ m/s^2$

$\Delta y = -50\ m$

$$V_f^2 = V_i^2 + 2a_g\Delta y$$

$$V_f = \pm\sqrt{(-10\ m/s)^2 + 2(-9.8\ m/s)(-50\ m)}$$

$$= -32.9\ m/s$$

a) $V_f = V_i + a_g t$

$$t = \frac{V_f - V_i}{a_g}$$

$$= \frac{-32.9\ m/s - (-10\ m/s)}{-9.8\ m/s^2}$$

$$= 2.33\ s$$